United Nations

FCCC/ARR/2013/USA

Framework Convention on Climate Change

Distr.: General
15 April 2014

English only

Report of the individual review of the inventory submission of the United States of America submitted in 2013*

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

GE.14-60680

1460680

Please recycle

Contents

		Paragraphs	*Page*
I.	Introduction and summary	1–5	3
II.	Technical assessment of the inventory submission	6–109	5
	A. Overview	6–25	5
	B. Energy	26–44	12
	C. Industrial processes and solvent and other product use	45–63	17
	D. Agriculture	64–78	21
	E. Land use, land-use change and forestry	79–99	24
	F. Waste	100–109	31
III.	Conclusions and recommendations	110–111	34
	A. Conclusions	110	34
	B. Recommendations	111	35

Annexes

I.	Background data on recalculations in the 2013 inventory submission	41
II.	Documents and information used during the review	43
III.	Acronyms and abbreviations	44

I. Introduction and summary

1. This report covers the review of the 2013 inventory submission of the United States of America, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 2 to 7 September 2013 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Riccardo de Lauretis (Italy); energy – Ms. Renee Kidson (Australia), Mr. Ricardo Fernandez (European Union), Mr. Daniel Tutu Benefoh (Ghana) and Mr. Sangay Dorji (Bhutan); industrial processes and solvent and other product use – Ms. Valentina Idrissova (Kazakhstan) and Mr. Stanford Mwakasonda (United Republic of Tanzania); agriculture – Mr. Jean Stephan (Lebanon) and Mr. Kohei Sakai (Japan); land use, land-use change and forestry (LULUCF) – Ms. Marina Vitullo (Italy), Mr. Eiichiro Nakama (Japan) and Mr. Richard Volz (Switzerland); and waste – Ms. Estela Santalla (Argentina) and Mr. Kai Skoglund (Finland). Mr. de Lauretis and Mr. Tutu Benefoh were the lead reviewers. The review was coordinated by Mr. Vitor Góis Ferreira (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (hereinafter referred to as the UNFCCC review guidelines), a draft version of this report was communicated to the Government of the United States, which made no comment on it. All encouragements and recommendations in this report are for the next inventory submission, unless otherwise specified. The expert review team (ERT) notes that the 2012 annual review report of the United States was published after the submission of the 2013 inventory submission.

3. In 2011, the main greenhouse gas (GHG) in the United States was carbon dioxide (CO_2), accounting for 84.1 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (8.6 per cent) and nitrous oxide (N_2O) (5.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 86.2 per cent of total GHG emissions, followed by the agriculture sector (6.9 per cent), the industrial processes sector (4.9 per cent), the waste sector (1.9 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 6,665,700.87 Gg CO_2 eq and increased by 8.0 per cent between the base year (1990) and 2011. The ERT concludes that the description in the national inventory report (NIR) of the trends for the different gases and sectors is transparent, informative and reasonable.

4. Tables 1 and 2 show GHG emissions under the Convention, by gas and by sector, respectively. In table 1, CO_2, CH_4 and N_2O emissions do not include emissions and removals from the LULUCF sector.

5. Additional background data on recalculations by the United States in the 2013 inventory submission can be found in annex I to this report.

[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

Table 1
Greenhouse gas emissions by gas, 1990 to 2011

	Gg CO_2 eq								*(%)*
Greenhouse gas	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*2011*	*Change 1990–2011*
CO_2	5 100 693.96	5 416 155.70	5 962 701.49	6 100 403.13	5 935 183.73	5 509 601.36	5 727 038.60	5 603 820.59	9.9
CH_4	637 439.98	632 868.13	597 493.59	585 614.69	610 114.02	598 076.49	588 041.55	573 063.23	–10.1
N_2O	341 253.70	384 621.23	347 885.07	347 697.61	340 820.96	332 296.71	338 270.27	343 468.24	0.6
HFCs	36 924.10	64 035.14	104 964.81	115 002.68	117 451.89	111 949.05	121 275.07	128 951.68	249.2
PFCs	20 645.87	15 587.02	13 473.80	6 194.63	6 607.08	4 458.52	5 946.51	7 017.60	–66.0
SF_6	32 634.53	27 959.51	18 827.49	14 986.61	11 391.23	9 815.90	10 070.11	9 379.53	–71.3

Table 2
Greenhouse gas emissions by sector, 1990 to 2011

	Gg CO_2 eq								*(%)*
Sector	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*2011*	*Change 1990–2011*
Energy	5 267 347.08	5 575 988.21	6 119 611.96	6 251 617.44	6 096 242.58	5 699 176.63	5 889 117.78	5 745 698.03	9.1
Industrial processes	316 147.45	339 357.00	352 433.19	330 765.41	318 710.08	265 319.84	303 439.65	326 461.30	3.3
Solvent and other product use	4 404.02	4 587.52	4 879.50	4 387.15	4 387.15	4 387.15	4 387.15	4 387.15	–0.4
Agriculture	413 861.23	459 501.19	432 176.83	446 188.00	463 583.76	459 190.57	462 269.97	461 496.95	11.5
LULUCF	–780 846.50	–782 377.09	–650 683.94	–972 467.78	–875 410.10	–862 181.53	–869 094.35	–868 416.37	11.2
Waste	167 832.35	161 792.82	136 244.78	136 941.34	138 645.34	138 123.85	131 427.57	127 657.44	–23.9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**5 388 745.64**	**5 758 849.63**	**6 394 662.32**	**6 197 431.56**	**6 146 158.81**	**5 704 016.51**	**5 921 547.77**	**5 797 284.50**	**7.6**
Total (without LULUCF)	**6 169 592.14**	**6 541 226.73**	**7 045 346.25**	**7 169 899.34**	**7 021 568.90**	**6 566 198.03**	**6 790 642.12**	**6 665 700.87**	**8.0**

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable.

II. Technical assessment of the inventory submission

A. Overview

1. Inventory submission and other sources of information

6. The 2013 annual inventory was submitted on 12 April 2013; it contains a complete set of common reporting format (CRF) tables for the period 1990–2011 and an NIR. The inventory submission was generally submitted in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines).

7. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

8. Table 3 contains the ERT's overall assessment of the inventory submission of the United States. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the inventory submission

		General findings and recommendations
The ERT's findings on completeness of the 2013 inventory submission		
Non-land use, land-use change and forestry[a]	Not complete	Mandatory: CO_2, CH_4 and N_2O emissions from gaseous fuel use in railways and navigation; CH_4 and N_2O emissions from gaseous fuel use in other transportation (pipeline transport); CH_4 and N_2O emissions from the use of biomass in other (stationary fuel combustion) (United States territories); CO_2, CH_4 and N_2O emissions from solid, gaseous and biomass use in other mobile (military); N_2O emissions from oil flaring; CO_2 emissions from calcium carbide production; CH_4 emissions from styrene production; PFC emissions from production of halocarbons and SF_6 (fugitive emissions); CH_4 emissions from enteric fermentation and manure management for buffalo, and camels and llamas; and CH_4 emissions from sludge under industrial wastewater
		Non-mandatory: CO_2, CH_4 and N_2O emissions from the use of other fuels in other (stationary fuel combustion) (United States territories) and other mobile (military); CH_4 and N_2O emissions from ammonia production; CO_2 emissions from ethylene production; CH_4 emissions from calcium carbide consumption; CO_2 emissions from food and drink; PFC and SF_6 emissions from semiconductor

		General findings and recommendations
		manufacture (stock and disposal); N_2O emissions from manure management for buffalo, and camels and llamas; CH_4 and N_2O emissions from field burning of agricultural residues (barley, oats, rye, peas and potatoes); CH_4 emissions from waste incineration (biogenic); and N_2O emissions from industrial wastewater (wastewater and sludge), and domestic (sludge) and commercial wastewater
Land use, land-use change and forestry[a]	Not complete	Mandatory: carbon stock changes and CO_2 emissions from mineral soils under forest land, living biomass under cropland and grassland, dead organic matter under land converted to cropland and land converted to grassland, land converted to wetlands, soils under land converted to settlements and land converted to other land; N_2O emissions from disturbance associated with land-use conversion to cropland; CH_4 and N_2O emissions from biomass burning (land converted to forest land, cropland, grassland and wetlands); and CO_2 emissions from biomass burning (excluding forest land remaining forest land) (see paras. 80–82 below) Non-mandatory: carbon stock changes and CO_2 emissions in dead organic matter under cropland remaining cropland and grassland remaining grassland, wetlands remaining wetlands, soils under settlements remaining settlements, and all carbon pools under other land remaining other land; N_2O and CH_4 emissions from drainage of soils and wetlands; and CH_4 and N_2O emissions from biomass burning (wetlands remaining wetlands, settlements and other land) (see para. 80 below)
The ERT's findings on recalculations and time-series consistency in the 2013 inventory submission	Generally consistent	Recalculations have been performed and reported generally in accordance with the IPCC good practice guidance. The rationale and description for these recalculations is provided in the NIR and in CRF table 8(b). However, the ERT notes that there are breaks in the time series for a number of categories, such as refineries and manufacturing industries and construction, before and after 2010 (see para. 11 below)
The ERT's findings on verification and quality assurance/quality control procedures in the 2013 inventory submission	Sufficient	The ERT considers that the Party's QA/QC plan, as described in the NIR, is in accordance with the IPCC good practice guidance. Both tier 1 and tier 2 QC activities are generally in line with the IPCC good practice guidance (see paras. 34, 57, 68 and 84 below). In addition, the United States used data from GHGRP for QA/QC purposes for a number of categories, and the inventory is also subjected to QA through a public review by the United States (see paras. 12–13 below)

		General findings and recommendations
The ERT's findings on the transparency of the 2013 inventory submission	Generally sufficient	The NIR generally provides much of the information on methodologies and approaches necessary to assess the inventory and follows the structure outlined in the UNFCCC reporting guidelines. However, the ERT found some possibilities for improvement: the ERT recommends that the United States use the plant-specific emissions from GHGRP to improve the disaggregation of combustion and industrial process emissions (see para. 14 below); the ERT reiterates the recommendations in the previous review report that the United States include justifications for the decision to use default EFs from the 2006 IPCC Guidelines and other actions (see paras. 15, 48, 51, 62, 75 and 92 below) Category-specific issues on transparency are discussed in the relevant sector chapters of this report (see paras. 28, 30, 32, 33, 34, 37–39, 49, 51, 58, 60, 85, 90, 95, 98, 101, 102, 105 and 109 below)

Abbreviations: CRF = common reporting format, EF = emission factor, ERT = expert review team, GHGRP = Greenhouse Gas Reporting Program, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, NIR = national inventory report, QA/QC = quality assurance/quality control, UNFCCC reporting guidelines = "UNFCCC reporting guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

9. The ERT recommends that the United States improve the completeness of the inventory, in particular by providing estimates for those categories for which the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) provide methodologies and/or emission factors (EFs) (see table 3 above).

10. The ERT notes that the 2013 inventory submission of the United States included data from the United States Environmental Protection Agency (EPA) Greenhouse Gas Reporting Program (GHGRP) for the first time. This included using reported emissions for categories where GHGRP has complete coverage and a consistent methodology for the complete time series (e.g. adipic acid production, hydrochlorofluorocarbon-22 (HCFC-22) production, aluminium production). Emissions data from GHGRP were also used to improve the disaggregation of national-level activity data (AD) for the fuel combustion in manufacturing industries and construction, and improve comparability and transparency in the reporting in the CRF tables. The ERT commends the Party for this substantial quality improvement of its GHG inventory, which may lead to greater accuracy, completeness, transparency and comparability. The Party noted that most methodologies used in GHGRP

are consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, although facilities under GHGRP collect detailed information which is specific to their operations in accordance with detailed measurement standards and these standards may differ from the more aggregated data collected for the GHG inventory.

11. However, the ERT found gaps in the time series for a number of categories (e.g. petroleum refining and subcategories under manufacturing industries and construction) before and after 2010. Therefore, the ERT recommends that the Party ensure time-series consistency when using GHGRP data directly in its national GHG inventory, such as applying splicing techniques described in chapter 3.2 of the methodological choice of the IPCC good practice guidance. As mentioned in the previous review report,[2] the ERT reiterates the recommendation that the United States continue to explore legally binding agreements and/or memorandums of understanding with data provider institutions, especially for categories in the energy and industrial processes sectors which are not part of GHGRP, to ensure the timely availability of data and the consistency of the time series, as well as the full coverage of categories.

12. The United States has a quality assurance/quality control (QA/QC) plan entitled "Quality Assurance/Quality Control and Uncertainty Management Plan for the United States Greenhouse Gas Inventory: Procedures Manual for QA/QC and Uncertainty Analysis", which stipulates the tier 1 procedures used for the entire inventory. The key attributes of this plan are summarized in section 1.6 of the NIR. Where QA/QC activities for a particular category go beyond the minimum tier 1 level, further explanations are provided within the respective category section. Information on the QC procedures performed in individual sectors is provided in the sector chapters of the NIR.

13. The United States also used data from GHGRP in QA/QC procedures for a number of categories (e.g. to improve the estimation of CH_4 emissions from natural gas use for the period 1990–2010). The United States indicated that the GHGRP data are a top priority and that it plans to expand their use to other categories in its 2014 inventory submission. The ERT commends the Party for using the GHGRP data for QA/QC checks and recommends that the Party report on the results from these checks.

14. The United States noted that, unlike the reporting requirements under the UNFCCC reporting guidelines, some facility-level fuel combustion emissions reported under GHGRP may also include industrial process emissions. The ERT notes that fuel combustion emissions shall be reported under the energy sector and process emissions shall be reported under the industrial processes sector, according to the UNFCCC reporting guidelines. The ERT notes, however, that the United States continues to report non-energy use of fuels under the energy sector. The ERT considers that this reporting both reduces the transparency of the inventory and undermines the comparability with other Parties included in Annex I to the Convention (Annex I Parties). The ERT reiterates the recommendations in the previous review reports that the United States improve the transparency and comparability of the reporting by allocating these emissions to the correct categories in accordance with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines. The United States could also use GHGRP data as an important source of information to improve the disaggregation and reporting of non-energy use and combustion emissions, and the ERT encourages the Party to investigate that possibility.

15. As identified in previous review reports, the United States uses the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) and its default EFs to estimate and report GHG emissions from fossil fuel combustion. Notwithstanding the conclusion of the Subsidiary Body for Scientific and

[2] FCCC/ARR/2012/USA, paragraph 14.

Technological Advice at its thirtieth session,[3] the ERT notes that the UNFCCC reporting guidelines state that all Annex I Parties shall use the Revised 1996 IPCC Guidelines and the IPCC good practice guidance to estimate and report GHG emissions and removals by sinks. During the review, the United States mentioned to the ERT that the UNFCCC reporting guidelines allow the use of different methods from the Revised 1996 IPCC Guidelines to produce more accurate estimates. The ERT agrees with the Party but notes that, in accordance with the UNFCCC reporting guidelines, Annex I Parties may use their own national EF and AD, where available, provided that they are developed in a manner consistent with the IPCC good practice guidance, are considered to be more accurate, and are reported transparently. Therefore, the ERT recommends that the United States endeavour to follow the UNFCCC reporting guidelines, without compromising accuracy, in order to ensure the comparability of its emission estimates with those of other Annex I Parties. The ERT reiterates the recommendation made in previous review reports[4] that the United States improve the transparency of the NIR by including justifications for the decision to use default EFs from the 2006 IPCC Guidelines, where relevant. The ERT further noted that the use of the 2006 IPCC Guidelines by the United States could affect the comparability of the emission estimates with those of other Annex I Parties, for example in the case of the reporting of CO_2 emissions from urea in the LULUCF sector instead of in the industrial processes sector. The ERT therefore recommends that the Party report CO_2 emissions from urea in the industrial processes sector, in line with the current UNFCCC reporting guidelines (see para. 51 below).

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

16. The NIR describes the institutional arrangements for the preparation of the inventory. EPA is the lead federal government agency charged with compiling the GHG inventory and has overall responsibility for the national inventory. The Office of Atmospheric Programs (OAP) of EPA is responsible for the emission calculations provided in the inventory, as well as for the completion of the NIR and the CRF tables. The Office of Transportation and Air Quality (OTAQ) of EPA is also involved in calculating the emission estimates, in particular those for transport. OAP and OTAQ jointly coordinate the collection of AD and emission calculations at the individual category level by other institutions and ensure consistency and quality throughout the NIR and the CRF tables. Within OAP, an inventory coordinator compiles the entire inventory into the proper reporting format and is also responsible for the cross-cutting issues in the inventory. Other agencies and organizations are also involved in the preparation of the inventory, such as the Energy Information Administration (EIA) of the Department of Energy, which provides national fuel consumption data, the Department of Agriculture, the United States Geological Survey (USGS), the National Agricultural Statistics Service and the Federal Aviation Administration, (FAA), which supply the other relevant AD and parameters needed for the emission estimates.

17. The United States' inventory is prepared in a decentralized manner. Emission calculations for individual categories are the responsibility of individual category leads in different organizations, who also determine the most appropriate methodology, collect the best AD to use in the emission calculations based upon their expertise in the category, and coordinate with researchers and contractors familiar with the categories. Every year, the

[3] FCCC/SBSTA/2009/3, paragraph 98.
[4] FCCC/ARR/2012/USA, paragraph 25.

inventory coordinator prepares and distributes a memorandum with the aim of providing guidelines for those responsible for preparing the category estimates and associated text for the next United States GHG inventory, addressing issues related to the documentation procedures, the data management practices and the structure of the NIR, as well as procedures for providing data for the CRF tables.

18. In the NIR, planned improvements are reported in the sector chapters. However, as already identified in the previous review report, a general section reporting the list of planned improvements and their prioritization is not provided, and the explanations and clarifications regarding comments and recommendations provided in the previous review report were not included in the NIR. Therefore, the ERT reiterates the encouragement in the previous review report that the United States include in the NIR of its next inventory submission the list of major improvements planned and a time frame for their expected implementation.

19. During the review, the United States clarified how recommendations in the review reports are taken into consideration when allocating resources to improve different aspects of the inventory. The Party explained that ERT recommendations are an important consideration in sustaining the quality of the inventory submission, but there are additional domestic considerations which are not necessarily considered by the ERTs, such as those to address comments received during the expert review phase and the public review period. One example in 2013 was the implementation of improvements related to fugitive emissions from natural gas systems, which was also considered during budget planning for inventory improvements.

20. During the review, the United States was also able to provide information on some of the planned improvements regarding its 2014 inventory submission. Two of these improvements relate to the further disaggregation and improved time-series consistency for combustion emissions with the use of GHGRP data. The other improvement relates to the reporting of fugitive emissions from natural gas systems. The ERT encourages the Party to report this information in a dedicated section of the NIR.

Inventory preparation

21. Table 4 contains the ERT's assessment of the United States' inventory preparation process. For improvements related to specific categories.

Table 4
Assessment of inventory preparation by the United States of America

	General findings and recommendations
Key category analysis	
Was the key category analysis performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes

		General findings and recommendations
Approach followed?	Both tier 1 and tier 2	
Were additional key categories identified using a qualitative approach?	Yes	International bunker fuels
Does the United States of America use the key category analysis to prioritize inventory improvements?	Yes	
Are there any changes to the key category analysis in the latest submission?	Yes	CO_2 emissions from cement production and SF_6 used in magnesium foundries were identified as key categories in the 2012 inventory submission, but have not been identified as key in the 2013 inventory submission. In addition, the following categories have become key categories in the 2013 inventory submission: CH_4 emissions from forest land remaining forest land; N_2O emissions from forest land remaining forest land; CO_2 emissions from land converted to cropland; and N_2O emissions from pasture, range and paddock manure
Assessment of uncertainty analysis		
Approach followed?	Both tier 1 and tier 2	
Was the uncertainty analysis carried out consistent with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	Yes	The United States described in the NIR that one of its planned improvements is the uncertainty analysis, as most of the input parameter distributions are based on expert judgement rather than statistical characterizations of uncertainty. The ERT commends the Party for its proactive approach and encourages the Party to continue efforts to improve its uncertainty analysis, including the assessment of input parameters for AD and EFs in its future inventory submissions
Quantitative uncertainty (including LULUCF)	Level = –3 to 6%	
	Trend = 0 to 14%	
Quantitative uncertainty (excluding LULUCF)	Level = –2 to 5%	
	Trend = 3 to 13%	

Abbreviations: AD = activity data, EFs = emission factors, ERT = expert review team, LULUCF = land use, land-use change and forestry, NIR = national inventory report.

Inventory management

22. The United States has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories, key category identification and planned inventory improvements. The centralized archiving system is located at the EPA offices. Some components of the archive which are not available electronically, such as scientific papers and industry correspondence, are also kept as hard copies at EPA. During the review, the ERT was provided with the requested additional archived information.

4. Follow-up to previous reviews

23. The United States has implemented several recommendations made in previous review reports in its 2013 inventory submission, in particular by improving the disaggregation of its CRF reporting in line with the UNFCCC reporting guidelines and the use of data from GHGRP. The ERT commends the Party for this substantial improvement, which has helped to ensure comparability with other Annex I Parties.

24. The United States also implemented recommendations regarding its QA/QC plan to ensure the consistency between the NIR and the CRF tables, and improved the transparency of its NIR in response to issues raised during the in-country review in 2012. However, other recommendations made in previous review reports have not yet been implemented, notably regarding the completeness of the Party's reporting (see table 3).

5. Areas for further improvement identified by the expert review team

25. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 7 below.

B. Energy

1. Sector overview

26. The energy sector is the main sector in the GHG inventory of the United States. In 2011, emissions from the energy sector amounted to 5,745,698.03 Gg CO_2 eq, or 86.2 per cent of total GHG emissions. Since 1990, emissions have increased by 9.1 per cent. The key drivers for the rise in emissions are the increases in emissions from public electricity and heat production, and road transportation. Within the sector, 37.9 per cent of the emissions were from energy industries, followed by 30.3 per cent from transport, 13.6 per cent from manufacturing industries and construction and 9.7 per cent from other sectors. Fugitive emissions from fuels accounted for 4.8 per cent. The remaining 3.7 per cent were from other (fuel combustion), which includes incineration of waste, non-energy use, United States territories, other non-specified and mobile military use.

27. The Party has made substantial recalculations for the energy sector between the 2012 and 2013 inventory submissions following changes in the AD (see table 8 in annex I to this report). The main reason for the recalculations is that new and improved data are available from GHGRP (see para. 10 above) and the System for assessing Aviation's Global Emissions (SAGE) using the Aviation Environmental Design Tool (AEDT) replaced the preliminary AD reported for 2010.

28. As indicated in the previous review report, during the previous review, the United States informed the ERT that the use of GHGRP data would allow: the replacement of the

current emission estimates for categories where GHGRP has full coverage; the development of more accurate national EFs based on plant-specific measurements; and the disaggregation of the national emission estimates into more detailed categories and subcategories. The ERT welcomes the improvements in the 2013 inventory submission made by the United States regarding the use of new data to improve the accuracy, transparency and level of disaggregation of its inventory and its emission estimates. The ERT recommends that the Party, in its future inventory submissions, include information on the progress made in this regard and indicate which data have been sourced from GHGRP and which from other sources, including EIA, in order to improve the transparency of the inventory.

29. In terms of completeness, a number of categories in the 2012 inventory submission continue to be reported as "NE" (not estimated) due to a lack of relevant AD, such as: CO_2, CH_4 and N_2O emissions from gaseous fuels use in railways and navigation; CH_4 and N_2O emissions from gaseous fuels use in other transportation (pipeline transport); CH_4 and N_2O emissions from the use of biomass in other (stationary fuel combustion) (United States territories); CO_2, CH_4 and N_2O emissions from solid, gaseous and biomass use in other mobile (military) and N_2O emissions from oil flaring. The ERT reiterates the recommendations in previous review reports that the United States collect the necessary AD and EFs to prepare emission estimates for the combustion of biomass and other fuels for these categories, including those used in the United States territories, focusing resources, as appropriate, on improvements in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, and report the corresponding emissions. Further, the ERT reiterates the recommendations in the previous review reports that the Party ensure that emissions from solid fuels, gaseous fuels, biomass and other fuels used by the military are either estimated or reported or that the appropriate notation key is used.

30. The previous review reports noted that the inventory for the energy sector is not sufficiently transparent given that emissions from consumption of all fuel types for some categories (petroleum refining, manufacture of solid fuels and other energy industries, manufacturing industries and construction subcategories and agriculture/forestry/fisheries) were aggregated and reported under other (manufacturing industries and construction). The ERT noted that the situation has improved in the current submission and that individualized emission estimates for petroleum refining and manufacturing industries and construction subcategories were reported for all fuels excluding biomass and other fuels, for 2010 and 2011, and the ERT commends the Party for that improvement (see para. 39 below). However, the lack of disaggregation remains for years prior to 2010 and in some categories for the complete time series, such as agriculture/forestry/fisheries and venting and flaring under fugitive emissions (see para. 44 below), which, according to the information in the CRF tables, are reported under petroleum refining. Therefore, the ERT recommends that the Party continue its efforts to report emissions from all categories and for the full time series at the most disaggregated level, in line with the UNFCCC reporting guidelines.

2. Reference and sectoral approaches

31. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 32–38 below.

Table 5
Review of reference and sectoral approaches

	Paragraph cross references
Difference between the reference approach and the sectoral approach	Energy consumption:

		Paragraph cross references
	–1,827.33 PJ, –2.21% CO_2 emissions: –104,188.55 Gg CO_2 eq, –1.92%	
Are differences between the reference approach and the sectoral approach adequately explained in the NIR and the CRF tables?	Yes	
Are differences with international statistics adequately explained?	No	33, 34, 36, 37
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	Yes	35
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	No	38

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

Comparison of the reference approach with the sectoral approach and international statistics

32. The ERT observed that in CRF table 1.A(c), in comparing the differences in energy consumption between the reference and the sectoral approach, the United States did not subtract the energy consumption contained in non-energy use and feedstocks from the apparent energy consumption: the two columns "Apparent energy consumption" and "Apparent energy consumption (excluding non-energy use and feedstocks)" have identical data except for the inclusion of consumption of "other" only under the former. The ERT notes that apparent energy consumption (excluding non-energy use and feedstocks) is used for the comparison (see footnote 2 to CRF table 1.A(c)). Therefore, the ERT recommends that the Party revise its reporting by providing a more transparent clarification of how the difference in emissions between the two approaches is determined and which fuels are subtracted as non-energy use and feedstocks, in order to increase transparency and comparability with other Parties (see also para. 38 below).

33. The ERT observed that some values of fuel consumption reported in the CRF tables were lower than the International Energy Agency (IEA) data: for example, in 2011, up to 9.0 per cent for the apparent consumption of solid fuels; and up to 11.0 per cent for production of solid fuels. In response to a question raised by the ERT during the review, the United States indicated that EIA is responsible for gathering the official fuel production and consumption statistics for the United States and that these are the most appropriate AD for the energy sector of the inventory. Given that the reporting of the detailed energy balance to IEA is conducted by the same institution (EIA) that provides relevant data to EPA to compile the GHG inventory, the ERT believes that the Party should make relevant arrangements in order to ensure harmonized and appropriately disaggregated data and increase the transparency and comparability of the GHG emission estimates. In particular, the ERT believes that some of the discrepancies could be improved through greater integration of the main data sources to estimate GHG emissions. The ERT encourages the United States to strive to improve the link between its energy balance and the AD reported in the CRF tables, and ensure the coherence with GHGRP data and the energy statistics

provided by EIA for the relevant categories. The ERT notes that the overall consistency among these key data sources would help to improve aspects of the inventory such as time-series consistency, transparency and the comparability of emission estimates.

34. In the previous review report, the ERT noted that verification procedures regarding the comparison of data from the CRF tables with the IEA data were not established and that some data verification procedures, particularly for the preparation of emission estimates in the reference approach (e.g. coal types and imports and exports of different coal types), were not sufficient. The ERT also found several data mismatches between the EIA data used for the NIR and the IEA data. The ERT reiterates the encouragement in the previous review report that the Party, in close cooperation with EIA, make relevant arrangements and establish QA/QC and verification procedures in order to ensure harmonized and appropriately disaggregated data and increase the transparency and comparability of its GHG emission estimates.

International bunker fuels

35. The ERT identified discrepancies in the reporting of jet kerosene consumption (international aviation bunkers) in CRF tables 1.A(b) and 1.C for all years (e.g. for 2011, a consumption of –963,275.21 TJ is reported in CRF table 1.A(b) while 971,516.23 TJ is reported in CRF table 1.C). The ERT found that this inconsistency affects the emission estimates. Therefore, the ERT recommends that the Party harmonize and reconcile the data between the reference and the sectoral approach or furnish an adequate explanation of these inconsistencies, where appropriate.

36. The ERT identified that the fuel consumption in international aviation and marine bunkers, as reported in CRF table 1.C, differs from that reported to IEA; for international aviation bunkers, consumption of jet kerosene differs for most years, with discrepancies ranging from –15.0 per cent to +25.0 per cent. These discrepancies may be partially due to a different split between domestic and international fuel consumption. Figures for civil aviation (larger quantities) are up to 32.0 per cent lower in the CRF tables, making the aviation totals lower in the CRF tables by 6.0–19.0 per cent. In response to a question raised by the ERT during the review, the United States stated that the IEA values are not necessarily reported to be in line with the IPCC good practice guidance on the treatment of bunker fuels, but provided no detailed information on the reasons for the difference. To enable comparability with other Parties, the ERT encourages the United States to investigate these discrepancies and provide additional explanations in the NIR, where data differ significantly from the IEA data.

37. The ERT also noted that there appears to be an issue in the split between international marine bunkers and navigation. Consumption of gas/diesel oil and residual fuel oil in international marine bunkers is always lower in the CRF tables than in the IEA data, with discrepancies of over 100 per cent occurring in some years. Conversely, the values for navigation are systematically higher in the IEA data. In response to a question raised by the ERT during the review, the United States stated that it will investigate ways of improving the calculations. To ensure transparency and comparability, the ERT encourages the United States to reconcile and harmonize the data submitted to IEA with the EIA data used to prepare the GHG inventory.

Feedstocks and non-energy use of fuels

38. In CRF table 1.A.4, the United States reported aggregated data and emissions of liquid fuels, solid fuels and gaseous fuels under the subcategory non-energy use (other). The ERT again reiterates that, according to the Revised 1996 IPCC Guidelines, only emissions from fuels combusted for the use of their energy should be reported under fuel combustion. The ERT also reiterates the recommendation in the previous review reports

(contained in particular in the review reports of the Party's 2007, 2008, 2009, 2010 , 2011 and 2012 inventory submissions) that the United States reallocate the relevant emissions currently reported under the subcategory non-energy use (other) and part of the fuel used under the subcategory United States territories (other), because the Party's current practice is not in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance and reduces the transparency and comparability of the inventory.

3. Key categories

Stationary combustion: solid, liquid and gaseous fuels – CO_2, N_2O and CH_4

39. In previous review reports it has been noted that the categorization for the United States was carried out at the aggregated level under stationary combustion for each fossil fuel and that, in accordance with the IPCC good practice guidance, Parties should disaggregate categories to the level where the EFs are distinguished (e.g. coal for electric power, for industrial uses and for commercial/residential uses). The ERT commends the Party for using disaggregated data for some categories and subcategories for the years 2010 and 2011 in its 2013 inventory submission, in particular using data from GHGRP. However, for the years prior to 2010, the AD and emissions from the consumption of all fuels in the following categories were reported as included elsewhere ("IE"): petroleum refining; manufacture of solid fuels and other energy industries; iron and steel; non-ferrous metals; chemicals; pulp, paper and print; and food processing, beverages and tobacco. For 2010 and 2011, separated values of fuel consumption were reported for liquid, solid and gaseous fuels for all the above-mentioned categories except manufacture of solid fuels and other energy industries. Consumption of biomass and other fuels were still reported as "IE" for 2010 and 2011. Therefore, the ERT recommends that the United States complete the collection of AD for the consumption of biomass and other fuels for the years 2010 and 2011 in order to estimate these emissions and improve transparency and comparability with other Annex I Parties.

40. As identified in the previous review report, fuels used for the production of intermediate products that are exported from the United States are still deducted from the amount of fuel reported under the category other (stationary). The ERT strongly reiterates the recommendations made in the previous review reports that the Party not deduct the amount of fuel used for the production of intermediate products that are exported from the United States, since this fuel for production is combusted in the United States.

Civil aviation: liquid fuels - CO_2

41. The United States reported a decreasing overall trend of CO_2 emissions in this category. The 2011 value (132,581.25 Gg) is 11.2 per cent lower than the 1990 value (149,249.36 Gg). This decrease was reported mostly since 2000 (171,922.80 Gg). Responding to the ERT during the review, the Party attributed this decrease to improved operational efficiency, improvements in aircraft and engine technologies and accelerated retirement of older, less fuel-efficient aircraft. The ERT recommends that the United States include more complete justifications for the trend of CO_2 emissions in this category.

Coal mining and handling – CH_4

42. The ERT commends the United States for having used a tier 2 method in its 2013 inventory submission to estimate fugitive emissions from abandoned mines, including from abandoned surface mines.

43. The ERT notes that the Party has reported "NE" for recovery/flared CH_4 volumes from underground mines (post-mining activities). The Party stated in its comments to the CRF tables that it will seek to address the data gap in subsequent inventory submissions.

The ERT encourages the United States to make efforts to achieve full completeness of its reporting for this category in future inventory submissions.

Oil and natural gas – CO_2 and CH_4

44. The United States is commended for the pursuit of using detailed higher-tier methods for this category. However, the ERT noted that fugitive emissions from venting and flaring are still reported under petroleum refining (in accordance with the information provided in the CRF tables). The ERT considers that the incorporation of GHGRP data is an opportunity to improve the resolution and disaggregation of the emission estimates in this category, and recommends that the Party make efforts in that regard.

C. Industrial processes and solvent and other product use

1. Sector overview

45. In 2011, emissions from the industrial processes sector amounted to 326,461.30 Gg CO_2 eq, or 4.9 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 4,387.15 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Since 1990, emissions have increased by 3.3 per cent in the industrial processes sector, and decreased by 0.4 per cent in the solvent and other product use sector. The key driver for the rise in emissions in the industrial processes sector is the growth of HFC emissions from the substitution of ozone-depleting substances (ODS), which have increased drastically since 1990. Within the industrial processes sector, 41.1 per cent of the emissions were from consumption of halocarbons and SF_6, followed by 23.3 per cent from metal production, 17.9 per cent from mineral products and 15.6 per cent from the chemical industry. Production of halocarbons and SF_6 accounted for 2.1 per cent.

46. The industrial processes sector is generally complete, but emissions from some categories for which there are methodologies available in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance have not been included, such as CO_2 emissions from calcium carbide production and CH_4 emissions from styrene. The ERT noted a remark in the NIR of the 2013 inventory submission that the United States is planning to undertake research to determine whether calcium carbide production and consumption data are available in order to estimate the corresponding emissions, and noted that this plan was also included in the previous NIR without any follow-up. Therefore, the ERT reiterates the recommendation from the previous review report that the United States undertake action in order to enhance the completeness of its reporting.

47. The ERT noted that the reporting under the industrial processes sector is transparent for most categories, and noted improvements in the reporting of methodologies for the calculation of estimates in some cases, following recommendations in the previous review reports: there have been improvements in the use of notation keys and the explanation of methodologies, such as the explanation provided on the different sources of information and the temporary storage of CO_2 from ammonia production and urea use. There have also been improvements in QA/QC procedures, following the use of data from GHGRP for that purpose.

48. The ERT noted the predominant use of the methodological approaches from the 2006 IPCC Guidelines for the calculation of the sectoral emission estimates, including areas where previous review reports have recommended the use of the Revised 1996 IPCC Guidelines or the IPCC good practice guidance (e.g. the calculation and allocation of emissions from ammonia production). The Party stated in response to a question raised by the ERT that the applicability of the 2006 IPCC Guidelines to the United States' circumstances is very high given that the methodologies in this guidance were partly based on background information collected in the United States. The ERT notes that Parties

should follow the IPCC good practice guidance and, where necessary, apply higher-tier methods and country-specific EFs to ensure that comparability with other Parties is not compromised (see para. 15 above). Therefore, the ERT reiterates the recommendation in previous review reports that the Party provide justification for the use of the approaches or EFs from the 2006 IPCC Guidelines as country-specific EFs and methods with a clear justification that these were based on data from the United States.

2. Key categories

Cement production – CO_2

49. The Party used the IPCC tier 2 method to estimate CO_2 emissions from cement production, including consideration of the IPCC default cement kiln dust correction factor. The ERT noted that the Party reported in the NIR that it uses advanced clinker data to estimate cement production emissions. Responding to a question raised by the ERT during the review, the United States clarified that "advanced" means an advance publication or near-final estimates of the national data prior to the final publication by USGS; the advance estimates are typically published as part of a "commodity report" or "industry survey" publication and then finalized for the "yearbook". To improve the transparency of the reporting, the ERT recommends that the United States include this information in the NIR of its subsequent inventory submissions.

50. As referred to in the previous review report, the United States expects to receive plant-specific data for the estimation of emissions for this key category in its future inventory submissions, from 2015 onwards, using data from GHGRP. The ERT commends the Party for the planned improvement in the inventory process, which could increase the accuracy of the emission estimates.

Ammonia production – CO_2

51. In spite of an improvement in the reporting of methodological issues with regard to CO_2 emissions from ammonia production, the ERT noted that the Party continues to use the 2006 IPCC Guidelines to calculate and allocate CO_2 emissions (i.e. CO_2 emissions from urea are reported where urea is used). In previous review reports the ERT recommended that the Party report these emissions in line with the Revised 1996 IPCC Guidelines in its next inventory submission, which recommendation the Party did not follow. Therefore, the ERT strongly reiterates the recommendation in previous review reports on reporting. If the Party is unable to do so, the ERT recommends that the Party improve the transparency of its reporting and include a detailed CO_2 balance showing CO_2 emissions from ammonia production and emissions from agricultural and non-agricultural use of urea, ensuring that no underestimations or double counting occur.

Iron and steel production – CO_2

52. The United States uses the 2006 IPCC Guidelines to estimate emissions from this category and provides a detailed description of the emissions estimated using a methodology which is based largely on a mix of tier 2 and tier 1 approaches. The ERT encourages the Party to increase the use of country-specific methods and EFs, in particular by using the opportunity resulting from the GHGRP data.

53. The ERT noted that a separation of metallurgical coke production from iron and steel production has not been achieved because the AD and use of by-products overlap between metallurgical coke production and iron and steel production. The ERT recommends that the United States make efforts to report separately the emissions from these two production activities in its next inventory submission.

54. As identified in the previous review report, in the preparation of the carbon balance for coke plants, the Party has not accounted for natural gas used as fuel. The ERT reiterates

the recommendation in the previous review reports that the Party include a clear explanation of how natural gas used as fuel in coke plants in the iron and steel production process is reflected in the emission estimates within the inventory and in the carbon balance for activities related to iron and steel production, in order to ensure that there is no double counting of emissions.

Aluminium production – PFCs

55. The ERT noted that the Party's PFC emissions from aluminium production are based on methodologies and equations specific to the GHGRP data together with technology-specific IPCC default parameters. These are reported in the NIR to be based on tier 2/tier 3 approaches. The United States reported that certain data elements, for example primary aluminium production, anode effect frequency and duration, and slope coefficients, are regarded as confidential business information that cannot be reported under GHGRP at the present time. The ERT understands and acknowledges the confidentiality requirements in the national GHG reporting process. Notwithstanding this, the ERT has noted that the implied emission factor (IEF) for PFC emissions from aluminium production has been consistently decreasing since 1990: the 2011 value for the perfluoromethane (CF_4) IEF (0.18 kg/t) is 69.8 per cent lower than the 1990 value (0.60 kg/t); the overall trend of the perfluoroethane (C_2F_6) IEF is also decreasing and the 2011 value (0.03 kg/t) is 53.4 per cent lower than the 1990 value (0.07 kg/t). The ERT recommends that the Party provide the explanation behind this decrease, given that the NIR does not mention any technological advancement in aluminium production that could have resulted in low PFC emission intensity.

SF_6 used in aluminium and magnesium foundries – SF_6

56. The United States reported in the NIR that SF_6 emissions from magnesium foundries in the period 1999–2010 were estimated on the basis of SF_6 consumption, which was assumed to be equivalent to emissions. After 2010 only certain industrial plants provided information on SF_6 consumption and, therefore, emissions were estimated on the basis of the quantity of metal processed and using emission rates from previous years. The ERT noted a consistent decrease in SF_6 emissions from magnesium foundries: the 2011 value (0.06 Gg) is 74.2 per cent lower than the 1990 value (0.23 Gg), and that the NIR does not provide clear information on the reasons for this decrease. The ERT recommends that the United States provide clear information on what has led to the decrease in SF_6 emissions despite the global increase in magnesium demand. The ERT encourages the Party to make efforts to use absolute values of SF_6 consumption figures for emission estimation for the complete time series.

Production of HCFC-22 – HFC-23

57. The United States reports in the NIR that, to estimate HFC-23 emissions since 1990, methods comparable to a combination of the tier 1 and tier 3 methods in the 2006 IPCC Guidelines were used. The emission estimates for 2010 and 2011 were obtained through reports submitted by production facilities to GHGRP. It is further reported in the NIR that, since 2010, emissions were revised downward by 1.7 Tg CO_2 eq, or 21.0 per cent, reflecting a correction made by one plant to its estimated emissions for that year following the discovery of a malfunction in a flow meter totalizer. The ERT recommends that the Party ensure that the necessary QA/QC and verification measures are implemented at plant level to ensure that the continuous monitoring results in more accurate estimates.

Consumption of halocarbons and SF_6 – HFCs and SF_6

58. The United States included five main activities of ODS consumption in this category, namely, refrigerators/air conditioning, aerosols, foams, solvents and fire protection. The ERT welcomes the detailed description of the data-gathering process and

the EPA Vintaging model application as well as the discussion on the uncertainty analysis in the NIR and its annexes. However, the ERT noted that no information was provided in the NIR on the basis and factors used in the model to calculate equipment disposal quantities and equipment disposal emission rates. During the review, the Party provided additional information on the assumptions used by the model to calculate disposal: the Vintaging model estimates the number of units reaching end of life based on bottom-up stock estimates and assumed equipment lifetimes; disposal EFs were developed based on consideration of the original charge size, the percentage of refrigerant likely to remain in equipment at the time of disposal, and recovery practices assumed to vary by gas type (ODS vs. HFCs). The Party also provided disposal loss rate assumptions for selected equipment categories. The ERT recommends that the Party include this information in the NIR of its subsequent inventory submissions in order to improve the transparency of its reporting.

59. The United States reported in the NIR that, for the first time, the inventory methodology incorporates SF_6 emission estimates from electric power systems using data from GHGRP. The ERT recognizes that this approach enhances emission estimate completeness and accuracy for this category. The ERT commends the Party for such improvement.

3. Non-key categories

Lime production – CO_2

60. The United States reported in the NIR the use of a tier 2 approach in accordance with the 2006 IPCC Guidelines to estimate lime production emissions, including provision for a lime kiln dust correction factor. The ERT noted that the Party made a revision of quicklime and hydrate lime production data for 2007, 2008 and 2010, but this recalculation was not transparently reported in the NIR. The ERT recommends that the United States provide adequate background information on the nature of data revisions in the NIR of its subsequent inventory submissions.

61. The previous review report also noted that, to estimate emissions from lime production for limestone and dolomite, the Party used EFs that were calculated considering 95 per cent of lime content in the final product, while the Revised 1996 IPCC Guidelines recommends 100 per cent. The ERT reiterates the recommendation in the previous review report that the United States either use the assumptions required by the Revised 1996 IPCC Guidelines or move to the use of higher-tier country-specific EFs and provide appropriate justification for the values used in the next inventory submission.

Nitric acid production – N_2O

62. The United States claims to use a tier 2 approach from the 2006 IPCC Guidelines to estimate N_2O emissions from nitric acid production. The EF was determined as a weighted average of two measured EFs. The Party reported that limited information is available over the time series, including plant-specific production levels, abatement technology type and installation date, and accurate destruction and removal efficiency rates. The ERT recommends that the United States make further efforts to enhance the accuracy of the emission estimates for this category for the whole time series, and provide clear justification for using the 2006 IPCC Guidelines and a clear description of the methodology used and the emissions trend, and changes in the methodologies and parameters used.

Adipic acid production – N_2O

63. The ERT commends the use by the United States of plant-specific measurement data, where available, to estimate N_2O emissions from adipic acid production, including provision for the consideration of emission control technologies. The correction factors

used are in line with the IPCC good practice guidance. The ERT encourages continued efforts by the Party in estimating emissions based on the continuous emission monitoring of the control systems used by the plants that are able to provide such plant-specific data.

D. Agriculture

1. Sector overview

64. In 2011, emissions from the agriculture sector amounted to 461,496.95 Gg CO_2 eq, or 6.9 per cent of total GHG emissions. Since 1990, emissions have increased by 11.5 per cent. The key driver for the rise in emissions is the increased use of liquid and anaerobic animal waste management systems (AWMS) in the dairy cattle and swine industry, which led to an increase in emissions from manure management. Within the sector, 53.6 per cent of the emissions were from agricultural soils, followed by 29.8 per cent from enteric fermentation, 15.2 per cent from manure management and 1.4 per cent from rice cultivation. The remaining 0.1 per cent were from field burning of agricultural residues.

65. The United States made recalculations for the agriculture sector between the 2012 and 2013 inventory submissions following changes in methods and AD. The impact of these recalculations on the agriculture sector was significant: an increase in emissions of 7.9 per cent for 2010 (see table 8 in annex I to this report). The main recalculations took place in agricultural soils (17.7 per cent increase), and the main reasons for the increase were updates to DAYCENT model inputs, including the MODIS enhanced vegetation index, and the national resources inventory as the basis for crop histories, tillage practices and fertilizer use. Significant recalculations were also reported for CH_4 emissions from enteric fermentation from horses, showing a decrease of 55.2 per cent for 2010. The main reason for the decrease in emissions from enteric fermentation from horses was a change of population data source from the Food and Agriculture Organization of the United Nations (FAO) to the United States Department of Agriculture (USDA) made in order to eliminate the uncertainty associated with the FAO data.

66. The United States' inventory for the agriculture sector is generally complete: emissions for all years, categories and gases for the total national territory have been estimated; however, part of CH_4 emissions from enteric fermentation are not estimated (see para. 69 below). The NIR is generally transparent with an elaborated annex to supplement the main text; some issues that affect transparency are discussed below in the category-specific paragraphs.

67. In the previous review report, the ERT recommended that the United States provide in the NIR a better description of the type of statistical data on which the AWMS are based.[5] The ERT commends the Party for having updated this information in the annex to the NIR (A-259 to A-261 of the NIR).

68. In the previous review report, the ERT also recommended that the United States revise its QA/QC procedures with regard to recalculations between inventory submissions.[6] The United States informed the ERT during the review that a new version of the manual for the QC plan (see para. 12 above) was being prepared, following the development of new methods for the calculation of N_2O emissions from agricultural soils. The final version of the manual will be made available for the next inventory submission. The ERT encourages the Party to continue with these efforts to enhance the QA/QC system.

[5] FCCC/ARR/2012/USA, paragraph 87.
[6] FCCC/ARR/2012/USA, paragraph 82.

2. Key categories

Enteric fermentation – CH_4

69. In the previous review report, the ERT recommended that the United States include emissions from calves younger than seven months when they feed on anything other than milk. In the 2013 submission, the ERT noted that CH_4 emissions from calves under seven months which could be fed on anything other than milk are still excluded from the estimates. In response to a question raised by the ERT during the review, the Party informed the ERT that it is working to develop methodologies for including enteric emissions from calves aged four to six months in the next inventory submission, assuming fractions of forage to milk (25.0, 50.0 and 75.0 per cent, respectively, for four, five and six months) and values for the methane conversion rate (Ym) based on published reports for dairy calves.[7] For beef calves, the Party will use the Ym from beef replacement heifers for beef calves. Digestible energy (DE) intake values for calves will be the same as those for the slightly older replacement cattle. The ERT commends the Party's intentions, reiterating the recommendations that the United States include emissions from calves during the time period when they feed on anything other than milk according to the Party's information.

Manure management – CH_4 and N_2O[8]

70. In the 2013 submission, the United States has included estimates of emissions from manure management from mules, burros and donkeys in accordance with recommendations in the previous review report. The ERT commends the Party for this improvement.

71. The ERT noted that volatile solids (VS) daily excretion per animal for dairy cattle increased from 1990 to 2011 (by 22.8 per cent, from 4.94 to 6.07 kg dry matter per head per day (dm/head/day)). On the other hand, the nitrogen (N) excretion rate (Nex) per animal decreased over the same period (by 4.2 per cent, from 130.09 to 124.58 kg N/head/year). During the review, in response to a question raised by the ERT, the Party explained the reason for these different trends between N excretion and VS daily excretion, including the provision of a table with detailed data. Basically, VS increased due to increased gross energy intake and milk production. The decrease of the Nex was explained by the following two factors: the increase in N retained for milk for daily cows was generally greater than the overall N consumption; and that N consumption for dairy heifers decreased by the decrease of the percentage of crude protein in diet, notwithstanding the increase in gross energy intake. The ERT considered that the explanations provided by the Party are sufficient to resolve the questions. The ERT recommends that the United States include such explanations in the NIR of its next inventory submission.

72. The ERT also noted that the VS daily excretion per animal decreased from 1990 to 2011 for sheep (by 9.8 per cent, from 0.63 to 0.57 kg dm/head/day) and remained more or less stable for swine over the same period (0.29 kg dm/head/day). On the other hand, the Nex per animal increased for the same species (sheep: by 7.1 per cent, from 10.52 to 11.28 kg N/head/year; swine: by 19.4 per cent, from 8.47 to 10.12 kg N/head/year). In response to a question by the ERT during the review, the United States explained that the different trends between Nex and VS daily excretion are due to changes in the estimation methodology as well as changes to animal genetics and diets: VS and N excretion rates were estimated from data from different versions of USDA agricultural waste management

[7] Soliva CR. 2006. "Report to the attention of IPCC about the data set and calculation method used to estimate methane formation from enteric fermentation of agricultural livestock population and manure management in Swiss agriculture", citing methods from Estermann (2001).

[8] Not all emissions related to all gases under this category are key categories, particularly N_2O emissions. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

field handbooks, which use different methods (the 1996 and 1998 versions are based on collected measurements; the 2008 version is based on a calculation method developed by the American Society of Agricultural and Biological Engineers, which is based on United States animal dietary intake and performance measurements). The ERT considered that the explanation given by the Party is not sufficient to resolve the question of a different time time-series trend and, in addition, it appears that there is a problem in the consistency of the time series. Therefore, the ERT recommends that the United States investigate the reasons for the difference in trends between Nex and VS daily excretion for sheep and swine, ensuring that the time series is consistent and in accordance with the IPCC good practice guidance, and describe the results in the NIR of its next inventory submission.

Agricultural soils – N_2O

73. The United States uses the DAYCENT model to estimate the majority of the N_2O emissions from agricultural soils. DAYCENT is a sophisticated model taking into account several country-specific parameters at a detailed spatial level. The model also undergoes constant improvements; for example, additional calibration points are regularly added. For the 2013 inventory submission, the model was improved and emissions recalculated for agricultural soils. The ERT commends the Party for its efforts to improve the accuracy of the inventory.

74. In CRF table 4.D, regarding cultivation of histosols, the ERT noted an inconsistency in the reported area of cultivated organic soils between the NIR and the CRF table (e.g. NIR: 0.66 Mha (shown in annex 3-11), CRF table: 646,203.08 ha for 2011). During the review, the Party acknowledged to the ERT that the area of cultivated organic soils used for estimating N_2O emissions in the agriculture sector had not been updated, while it had been for the LULUCF sector. and stated that it will be updated in the next inventory submission. The ERT recommends that the United States revise the AD and emission estimates for cultivation of histosols in agricultural soils and revise its QC process in order to ensure consistency in the inventory. In addition, the ERT recommends that the Party provide information on these improvements in its next inventory submission.

75. As identified in the previous review report, the United States uses default EFs from the 2006 IPCC Guidelines to estimate N_2O emissions from pasture, range and paddock. The ERT noted that the explanations of the justification for the use of the 2006 IPCC Guidelines defaults as more appropriate to the country conditions than the defaults in the IPCC good practice guidance were lacking in the NIR. Therefore, the ERT strongly reiterates the recommendation in the previous review report that the Party justify the reason for using the default EFs in the 2006 IPCC Guidelines.

76. In the previous review report, the ERT recommended that the United States explain the reason for the fluctuating IEFs for agricultural soils.[9] In the current inventory submission, the ERT noted that fluctuations of N_2O emissions for N leaching and run-off, which were recalculated, continue to be significant: 2000/01 (12.7 per cent), 2002/03 (–18.0 per cent), 2003/04 (58.8 per cent), 2004/05 (–32.4 per cent) and 2006/07 (66.1 per cent). During the review, in response to a question raised by the ERT, the Party explained that this resulted from the fact that the emissions were calculated using the DAYCENT model and due to the effect of weather patterns during the year, which influence water-filled pore space in soils, and the amount of N_2O emissions. In addition, the Party provided specific reasons for fluctuations between certain years, from 1992 to 1993, and from 2006 to 2007, when emissions increased drastically, due to floods. The ERT commends the Party for providing these explanations, but concluded that some of them were unclear (e.g. how flooding induced these variations and how they were captured by the methodology).

[9] FCCC/ARR/2012/USA, paragraph 91.

Nevertheless, the United States admitted that the reported IEF for N leaching and run-off was not accurate because the AD (application of N to soils) were incorrectly reported (the reported AD were for the total N input to soils for cropland and federal grassland; the correct value should have been the total amount of N that is volatilized for the atmospheric deposition and the total amount of N lost through leaching and run-off), although the emission estimates were accurate. The ERT reiterates the recommendation that the United States investigate the reasons for the fluctuation of N_2O emissions for N leaching and run-off, and provide these reasons in the NIR. In addition, the ERT recommends that the Party correct the identified errors and QC procedures to identify similar problems in future inventory submissions for this issue, and revise the AD as appropriate in its next inventory submission.

77. In the previous review report, the ERT recommended that the United States investigate the reason for the identified inconsistency in the total N excretion on pasture, range and paddock between relevant CRF tables. The ERT noted that this inconsistency has not been resolved in the current inventory submission: total N excretion on pasture, range and paddock is reported as 3,853,068,599.97 kg-N in CRF table 4.B(b) and as 3,845,162,828.27 kg-N in CRF table 4.D for 2011. During the review, the Party informed the ERT that this is explained by a late update by the contractors who develop the manure N data. The ERT strongly reiterates the recommendation in the previous review report that the Party resolve the inconsistency between CRF tables 4.B(b) and 4.D in its next inventory submission. It also reiterates the recommendation that the Party improve its QC procedures to avoid such inconsistencies in future inventory submissions and provide information on these improvements in its next inventory submission.

78. In the previous review report, the ERT noted that no data on fractions are reported in the additional information table of CRF table 4.D, and it was recommended that the United States include weighted national averages in CRF table 4.D. The ERT noted that the situation has not been resolved in the current inventory submission and strongly reiterates the same recommendation to the Party to be implemented in the next inventory submission.

E. Land use, land-use change and forestry

1. Sector overview

79. In 2011, net removals from the LULUCF sector amounted to 868,416.37 Gg CO_2 eq. Since 1990, net removals have increased by 11.2 per cent. The key drivers for the rise in removals are management practices that increased the carbon stocks on forest land, afforestation and reforestation efforts, and the enlargement of forest land in the United States (current trends of the increase in forest area show an average annual increase of 0.2 per cent). Within the sector, 735,700.88 Gg of net removals were from forest land, followed by 84,706.28 Gg of net removals from other (harvested wood products (HWP) in use and in solid waste disposal sites, and landfilled yard trimmings and food scraps), 67,342.49 Gg of net removals from settlements and 1,354.10 Gg of net removals from grassland. Cropland accounted for 19,765.20 Gg of net emissions; and wetlands for the remaining 922.18 Gg of net emissions.

80. The inventory for the LULUCF sector is not complete and several categories and pools are not estimated. These include: the carbon stock changes and CO_2 emissions from mineral soils under forest land, living biomass under cropland and grassland, dead organic matter (DOM) under land converted to cropland and land converted to grassland, land converted to wetlands, soil organic carbon (SOC) under land converted to settlements and land converted to other land; N_2O emissions from disturbance associated with land-use conversion to cropland; CH_4 and N_2O emissions from biomass burning (land converted to forest land, cropland, grassland and wetlands); and CO_2 emissions from biomass burning

(excluding forest land remaining forest land). The ERT recommends that the United States estimate emissions for these categories in accordance with the IPCC good practice guidance for LULUCF. The following categories and pools that are not mandatory are also not estimated: the carbon stock changes and CO_2 emissions in DOM under cropland remaining cropland and grassland remaining grassland, wetlands remaining wetlands, SOC under settlements remaining settlements and other land remaining other land; N_2O and CH_4 emissions from drainage of soils and wetlands; and CH_4 and N_2O emissions from biomass burning (wetlands remaining wetlands, settlements and other land). The ERT encourages the Party to estimate emissions for these categories.

81. The United States has not reported estimates of the carbon stock changes in the living biomass and DOM pools for each conversion subcategory from forest land to any other land use in its CRF tables. Responding to a question raised by the ERT during the review, the United States explained that research is being conducted to refine the estimates of DOM stocks with published work already implemented in the 2013 inventory submission (Domke et al., 2013;[10] Woodall et al., 2013;[11] Woodall et al., 2012;[12] Domke et al., 2011;[13] and Harmon et al., 2013[14]), and it is expected that future development of a reliable land-use change (LUC) matrix could be coupled with refined estimates of forest carbon stocks by pool (e.g. dead wood). The ERT recommends that the United States conclude the technical work under way to be able to provide estimates for the carbon stock changes in the living biomass and DOM pools for each year based on a reliable LUC matrix, and report on the achievements made in its next inventory submission.

82. The ERT noted that the total national area, as reported in the CRF tables for all land uses, is not constant in the period 1990–2011, fluctuating between 626,241.40 kha (1998) to 632,793.56 kha (2012) and with inter-annual variations ranging between –6,261.25 kha (1992/93) to 2,456.58 kha (1993/94). The Party explains in the NIR that cropland and grassland and conversions to these land uses on federal lands are not included, leading to discrepancies between the total amount of these land uses and the amount reported in the inventory. Responding to a question raised by the ERT during the review, the United States explained that the inconsistencies arose as a portion of the managed land is currently not included in the CRF tables, although it is reported in the NIR (table 7-5); this area is mainly federally managed grassland in the western United States. The Party also stated that there is a planned improvement to conduct an inventory for the total area of grassland that is managed and not currently included in the inventory. The ERT commends the Party for this planned action and recommends that the Party include all managed federal lands in the inventory, improve the time-series consistency and report on the achievements made in the next inventory submission.

---

[10] Domke GM, Woodall CW, Walters BF and Smith JE. 2013. *From Models to Measurements: Comparing Downed Dead Wood Carbon Stock Estimates in the U.S. Forest Inventory.*

[11] Woodall CW, Walters BF, Oswalt SN, Domke GM, Toney C and Gray AN. 2013. Biomass and carbon attributes of downed woody materials in forests of the United States. *Forest Ecology and Management*. 305: pp.48–59.

[12] Woodall CW, Domke GM, MacFarlane DW and Oswalt CM. 2012. Comparing field- and model-based standing dead tree carbon stock estimates across forests of the United States. *Forestry*. 85: pp.125–133.

[13] Domke GM, Woodall CW and Smith JE. 2011. Accounting for density reduction and structural loss in standing dead trees: implications for forest biomass and carbon stock estimates in the United States. *Carbon Balance and Management*. 6: p.14.

[14] Harmon ME, Fasth B, Woodall CW and Sexton J. 2013. Carbon concentration of standing and downed woody detritus: effects of tree taxa, decay class, position, and tissue type. *Forest Ecology and Management*. 291: pp.259–267.

83. In addition, it is not clear to the ERT how the LUC matrices were used to construct the land representation data and in the estimation of emissions and removals. For instance, the ERT noted that areas of land converted to forest land have not been reported in CRF table 5.A and, in the period 2007–2011, constant values for the subcategories cropland remaining cropland and land converted to cropland were reported in CRF table 5.B. Responding to a question raised by the ERT during the review, the United States stated that it uses data from the National Resources Inventory (NRI) when estimating carbon stocks, except living biomass, in the subcategories cropland remaining cropland, land converted to cropland, grassland remaining grassland and land converted to grassland. As the most recent data are from 2007, the data from that year are used for all subsequent years of the time series. The Party also informed the ERT that, currently, the Government has not published land-use change data for years after 2007, although they are available, and so the data from 2008 to 2011 are based on 2007 projections. Estimates of areas and emissions/removals in the LULUCF sector will be updated after new land-use data are released. The ERT strongly recommends that the United States ensure land consistency and accuracy with the use of the LUC matrices, and provide detailed explanations in the NIR on changes in LUC areas over time. Regarding cropland, the ERT also recommends that the United States use more recent data as soon as possible.

84. The ERT identified several other discrepancies between land-use areas reported in the NIR and those reported in the CRF tables (the differences can be as high as the Party reporting 51,000 kha in NIR table 7-1 and 9,949.12 kha in CRF table 5.E for 2011).[15] The ERT strongly recommends that the United States check the coherence of reported data, applying the appropriate QC checks, in order to ensure the consistency and accuracy of the estimates.

85. The ERT noted that areas under land conversions have not been reported separately for different previous land-use categories in the following CRF tables: 5.B (information on all land converted to cropland is reported under grassland converted to cropland, and the remaining land conversions are reported as "IE"); 5.C (information on all land converted to grassland is reported under cropland converted to grassland, and the remaining land conversions are reported as "IE"); and 5.A (information onland converted to forest land is included under forest land remaining forest land and all land conversions are reported as not applicable ("NA")). The ERT considers that this creates a significant lack of transparency and comparability with other Parties. In response to a question raised by the ERT during the review, the United States informed the ERT that it is in the process of preparing the full set of conversion classes and that it plans to provide those estimates in its 2014 inventory submission. The ERT commends the United States for the efforts planned and recommends that it provide all estimates of land conversions to forest land, cropland and grassland in a disaggregated manner.

86. The ERT noted that several data sources were used to construct the land area representation: an NRI survey provided data for 1998; available data from the Forest Inventory and Analysis (FIA) are different for the various states (ranging from 2002 to 2012); and the National Land Cover Dataset, (NLCD), which is a land cover classification scheme available for 1992, 2001 and 2006. The ERT could not conclude how the data referring to various years, coverage and resolution, with different classification systems, have been harmonized and used to classify the territory according to the IPCC land-use categories. Responding to a question by the ERT during the review, the United States provided additional explanations related to the methods used in the land assessment, for each specific information source, such as the periodicity of data collection, corrections

[15] Similar findings were identified in the previous review report: see document FCCC/ARR/2012/USA, paragraph 98.

made to the original data in order to ensure consistency and the use of the data sources to construct the LUC matrices. The ERT concludes that this information was very useful and recommends that the United States include in subsequent inventory submissions such detailed information on how the different information data sources were harmonized and used to classify the territory in accordance with the IPCC land-use categories in a consistent manner.

87. The United States uses the model DAYCENT (tier 3 approach) to estimate the changes in soil carbon stocks for mineral and organic soils under cropland and grassland land uses. This model covers the majority of crops and around 85 per cent of the cropland and grassland area. For the remaining areas a tier 2 approach is applied. In the current submission, recalculations were made taking into consideration improvements in the model, new input data and extension of the model application to include more crops. The recalculations led to significant reductions of removals from cropland and grassland during the whole period since 1990, and cropland has even changed from net removals to net emissions after the year 2000 (see table 8 in annex I to this report). The United States has provided a detailed description of the DAYCENT model in an annex to the NIR, including country-specific reference carbon stocks of mineral soils and parameter factors to take into consideration the impact of management practices.

2. Key categories

Forest land remaining forest land – CO_2

88. The United States reported the area of land use and land-use changes into and out of six land-use categories in its NIR (table 7-6), including forest land remaining forest land, and all other land types converted to forest land. However, in CRF table 5.A, the United States reported information on the carbon stock changes in land converted to forest land as "IE", included under forest land remaining forest land. In the NIR (p.7-30), the Party explains that "Given the paucity of available land-use information relevant to this particular IPCC source category, it is not possible to separate CO_2 or N_2O fluxes on land converted to forest land from fluxes on forest land remaining forest land at this time". The United States also informed the ERT in response to a question raised during the review that since forest inventory data are obtained from the USDA Forest Service FIA programme, which does not include a spatially explicit analysis of land transitions into and out of forest land, it is thus not possible, using this data set, to monitor either the conversion of land into and out of forest, or the CO_2 fluxes associated with these conversions. Responding to another question raised by the ERT during the review, the United States explained that given the reliance on empirically derived forest inventory data (1990s to the present) to estimate forest stocks and stock changes, there is a technical hurdle to appropriately matching forest inventories with other land resource inventories to populate an LUC matrix. Research was initiated to both address the paucity of forest inventories across the 1990s (Domke et al., 2012;[16] Domke et al., in review[17]) (i.e. the accuracy of carbon baselines) and introduce remotely sensed land-use change information into forest stock and stock change estimation

[16] Domke GM, Woodall CW, McRoberts RE, Smith JS and Hatfield MA. 2012. Assessing estimation techniques for missing plot observations in the U.S. forest inventory. *In*: R Morin and G Likens (eds.) *Moving from Status to Trends: Forest Inventory and Analysis (FIA) Symposium 2012*. Gen. Tech. Rep. NRS-P-105. Newtown Square, PA: U.S. Department of Agriculture Forest Service, Northern Research Station. 478 p.

[17] Domke GM, Woodall CW, Walters BF, McRoberts RE and Hatfield MA. In review. Strategies to compensate for the effects of nonresponse on forest carbon baseline estimates from the national forest inventory of the United States. Intended outlet: PLoS Computational Biology.

procedures (Cohen, study in progress[18]), but, as some of these studies are years in scope, the United States would expect at least a few years for the completion of studies, with additional years needed for implementation. The ERT reiterates the recommendation in the previous review report that the United States conclude the technical work under way to implement this integrated approach for tracking land-use change and estimate the forest carbon stock and changes for each subcategory of LULUCF year by year, based on the most recent data from the forest inventory and remotely sensed land-use change information. The ERT encourages the United States to develop temporary alternative methods to be able to report disaggregated information until the results from the detailed studies become available.

89. As identified in the 2011 review report,[19] the United States does not always ensure that the same area is used over years when applying the stock change method to calculate the carbon stock changes, which is not consistent with the IPCC good practice guidance for LULUCF. Responding to a question raised by the ERT during the review, the United States explained that it hopes that the application of a consistent remote sensing platform from the 1980s to the present (Landsat) to the issue of land-use change may enable more accurate stock change accounting, especially across the 1990s, when forest field inventory data are inconsistent (i.e. varying techniques by state and by year). The ERT reiterates the recommendation in the previous review report that when the United States applies the stock change method, it calculate the carbon stock values at two consecutive points in time in the same area.

90. In CRF table 5.A, the United States has reported the carbon stock changes for forest land remaining forest land in the mineral soils pool as "NE", and the carbon stock changes under organic soils with values (although the AD are reported as "NA"). The Party also explained in the NIR (p.7-23) that mean forest soil organic carbon densities are stratified by region and forest type group, and that the United States cannot provide separate estimates for mineral or organic soils but rather weighted values based on the relative amount of each within forest land. To overcome this problem with transparency, the ERT recommends that the United States make every effort to report the carbon stock changes in the mineral soils and organic soils pools separately. Meanwhile, while these data are not available, and the carbon stock changes in soils are being estimated by the weighted average of mineral soils and organic soils, these emissions should be reported under mineral soils (including the area of organic soils), where the area is available, while organic soils should be reported as "IE" (as well as the AD and implied carbon stock change factors).

91. The United States reported in the NIR (p.7-23) that SOC for forest values are a function of species and location, and do not reflect the effects of past land use (p.7-26 in the NIR). Assuming that SOC changes primarily occur within the first 10 years in the tropics and over several decades in temperate regions, the ERT considers that the degree of the changes in SOC may not be reflected in the carbon stock changes, in particular when land converted to forest land is not separated from land remaining forest land. However, responding to a question raised by the ERT during the review, the United States explained that it currently prepares annual estimates of forest SOC in forest floor and mineral soils

[18] Cohen WB. Study in progress. A historically consistent and broadly applicable MRV system based on lidar sampling and landsat time-series (tested in the United States and applied to US NGHGI). Funding source: NASA Carbon Monitoring Systems.

[19] FCCC/ARR/2011/USA, paragraph 96.

using models (Smith and Heath, 2002;[20] Amichev and Galbraith, 2004[21]) based on FIA plot-level forest information (e.g. forest type). The FIA programme has been collecting field samples of forest floor and mineral soil carbon in a consistent manner across the United States since 2001 (from thousands of plots). Work is currently under way to evaluate how these empirical data can inform or replace modelled estimates of forest floor carbon stocks, while other predictors of forest floor formation (e.g. climate, topography and landscape position) could be used as input to satellite pixels for mapping. The expected result will be an estimate of landscape-level forest floor carbon stocks from plot-level observations, and the United States expects to provide an update on this current research effort with the 2015 inventory submission. The ERT reiterates the recommendation in the previous review report[22] that the United States conclude the technical work to implement this integrated approach for tracking land-use change, and estimate the change in SOC for each subcategory of LULUCF year by year based on the plot-level empirical data and forest floor information, in order to enhance the accuracy of the inventory.

Cropland remaining cropland – CO_2

92. As identified in the previous review report, the United States reports CO_2 emissions from urea fertilization under cropland remaining cropland (CRF table 5(IV)), which is in line with the reporting method provided in the 2006 IPCC Guidelines, but is not in accordance with the current rules in the Revised 1996 IPCC Guidelines; these emissions should have been reported in the industrial processes sector. The ERT strongly reiterates the recommendation in the previous review report that the United States reallocate emissions from urea fertilization to the category ammonia production (industrial processes sector) in accordance with the Revised 1996 IPCC Guidelines in its next inventory submission.

93. As mentioned in the previous review report, the United States reports as "NE" the carbon stock changes in living biomass and DOM for cropland remaining cropland. The ERT considers that it is likely that there are changes in the carbon stocks in living biomass in perennial crops (e.g. orchards and vineyards). The ERT reiterates the recommendation in the previous review report that the United States estimate the carbon stock changes in living biomass for all years of the time series and report these changes in the subsequent inventory submission.

Settlements – CO_2

94. The United States has reported the carbon stock changes in urban trees under settlements remaining settlements, and the changes in net carbon flux from urban trees are based solely on the changes in the total urban area and an average of 35.0 per cent canopy cover. These estimates are based on field data on tree growth in cites and on the urban area. Data on the urban area are estimated from the United States census and have been extended from two years (1990 and 2000) in the previous submission to a third year (2010) in the current submission. The database on tree growth has also been extended from 14 to 28 cities. Recalculations using the new data resulted in estimates of net removals from settlements remaining settlements that are 30.7 per cent lower for 2010 than those reported in the previous inventory submission (from –96,596.36 to –67,342.49 Gg CO_2 eq). However, the United States stated further in its NIR that there is an overlap between the

[20] Smith JE and Heath LS. 2002. A model of forest floor carbon mass for United States forest types. Res. Pap. NE-722. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 37 p.

[21] Amichev BY and Galbraith JM. 2004. A revised methodology for estimation of forest soil carbon from spatial soils and forest inventory data sets. *Environmental Management*. 33 (Suppl. 1): S74–S86.

[22] FCCC/ARR/2012/USA, paragraph 103.

urban forest inventory and the forest inventory, and that it intends to eliminate this overlapping of the two inventories in the next inventory submission. The ERT commends the United States for the efforts made and planned, and recommends that the Party eliminate double counting in subsequent inventory submissions.

95. As identified in the previous review report, the United States reports in CRF table 5.E an annual increasing area of settlements remaining settlements, but reports land converted to settlements using the notation key "NE". However, the ERT notes that the United States reports the carbon stock changes for land converted to settlements together with the changes under the settlements remaining settlements category. The ERT considers that the most appropriate notation key would be "IE" for the carbon stock changes for land converted to settlements. The method used for estimating the carbon stock changes in urban trees, on the other hand, includes an increase of the urban area from 1990 to 2011 (by 44.9 per cent, from 6,865.74 kha to 9,949.12 kha), suggesting land conversions to settlements. The ERT therefore recommends that, as part of its integrated effort to develop a more complete land-use change data set, the United States conduct research to develop a land-use change data set allowing the Party to determine which land uses are converted to settlements. Growth of trees on areas converted to settlements might be different from those in existing urban areas and should be separately applied for the two subcategories. The ERT reiterates the recommendation of the previous review report that the United States improve the transparency of its reporting and document the different carbon stock changes in urban trees in settlements remaining settlements and land converted to settlements, including the revision of the notation keys used.

Other – CO_2

96. As identified in the previous review report, the United States reports in this category the carbon sequestration from yard trimmings and food scraps in landfills, and HWP. In the method presented in the NIR to estimate the carbon stock changes, specific decay values for yard trimmings and food scraps are used. On the other hand, the ERT noted that an aggregated value for all landfilled municipal solid waste is used for reporting emissions from landfills in the waste sector. To ensure the consistent use of decay values across the whole inventory, the ERT reiterates the recommendation in the previous review report that the United States reflect the intersectoral linkages and document the differences in the decay values in subsequent inventory submissions.

Biomass burning – CH_4 and N_2O

97. The United States has reported estimated CH_4 and N_2O emissions from forest fires in its NIR (table 7-13), but these values are different from those provided in the NIR annex (table A-253). Responding to a question raised by the ERT during the review, the United States explained that the values in the NIR (table 7-13) are only emissions from wildfires, and exclude (mistakenly) prescribed fire emissions. Table A-253 in the annex includes both wild and prescribed fire emission estimates and these values, which are used in the inventory, are therefore roughly 16 per cent higher. Also, the ERT noted that the United States has reported an equation for estimating non-CO_2 gases from forest fires in its NIR (p.7-27), which is different from the one reported in the annex to the NIR (p.A-359). In response to a question raised by the ERT during the review, the United States explained that the equation in page 7-27 is the correct one. The Party also stated that it will correct this situation in its next inventory submission. The ERT recommends that the United States provide information in the NIR consistent with that contained in the annex in its next inventory submission and strengthen its QC procedures to avoid these inconsistencies.

98. The United States has reported in its NIR (p.7-27) that emissions of non-CO_2 gases from forest fires were estimated using the default methodology in the IPCC good practice guidance incorporating default EFs from the 2006 IPCC Guidelines and a combustion

factor for wildfires. The ERT considers that the use of a value of 92.8 per cent to account for the proportion of carbon emitted as CO_2 in addition to the default combustion factor is not in accordance with section 3.2.1.4 of the IPCC good practice guidance for LULUCF (equation 3.2.20). Responding to a question raised by the ERT during the review, the United States explained that the 92.8 per cent value is based on expert opinion (James Smith, USDA Forest Service, e-mail to ICF and EPA, 3 December 2008). The ERT recommends that the United States present more transparent information to justify that the use of this extra value of 92.8 per cent for estimating the emissions of non-CO_2 gases is in accordance with the IPCC good practice guidance, in particular taking into consideration the additional research into the availability of a combustion factor specific to prescribed fires that has been mentioned in the planned improvements.

3. Non-key categories

Wetlands remaining wetlands – CO_2

99. As stated in the previous review report, while the United States describes the methodology and reports estimates for CO_2 and N_2O emissions from peatland in its NIR, estimates are reported in CRF table 5 but not in CRF table 5.D, where the notation keys "NA" for area and "NE" for estimates are used. Responding to a question by the ERT during the review, the United States explained that it has considered the limited methodology available in the 2006 IPCC Guidelines and that it could calculate estimates for peatland remaining peatland only. The Party informed the ERT that work is ongoing to provide AD and emission estimates in the CRF tables in its next inventory submission. The ERT encourages this intention and reiterates the recommendation of the previous review report that the United States improve the consistency between the NIR and the CRF tables and report the areas and the emission estimates in CRF tables 5.D and 5(II).

F. Waste

1. Sector overview

100. In 2011, emissions from the waste sector amounted to 127,657.44 Gg CO_2 eq, or 1.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 23.9 per cent. The key drivers for the fall in emissions are the decreasing trend of CH_4 emissions from solid waste disposal on land due to the decreased amount of solid organic waste disposed on landfills and the increased amount of landfill gas recovered. Within the sector, 80.7 per cent of the emissions were from solid waste disposal on land, followed by 16.7 per cent from wastewater handling and 2.6 per cent from other (composting of waste).

101. The inventory is generally complete and accurate, the QA/QC procedures cover all categories and the uncertainty estimates have been reported comprehensively. However, in the follow-up to the previous review report, the ERT notes that the inventory could be enhanced in several aspects related to transparency, completeness and accuracy; the inventory could be further improved in the following aspects: (a) estimates of non-hazardous industrial waste and medical waste incineration are not included in the inventory (see para. 108 below); (b) there is a lack of descriptions of the solid waste management practices and composition of waste (see para. 102 below); and (c) the constant value used for degradable organic carbon (DOC) does not consider the very likely changing waste composition over time (see para. 104 below). The ERT reiterates the recommendation that the United States further improve completeness, transparency and accuracy regarding these above-mentioned issues in future inventory submissions.

102. The previous review report noted that the United States informed the ERT that it was planning to provide descriptions of the waste management practices used in the

country in its next inventory submission. In spite of this, the ERT found no improvement in the description of the waste management practices in the NIR of the 2013 inventory submission and, therefore, reiterates the recommendation that the United States further improve transparency regarding this issue.

2. Key categories

Solid waste disposal on land – CH_4

103. To estimate emissions for this category, the United States used a tier 2 first-order decay (FOD) method in conjunction with country-specific AD. This is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The inventory is complete and the estimates cover emissions from both municipal and industrial landfills. The main source of AD (waste generated and landfilled) for municipal solid waste is a biennial survey, *The State of Garbage in America* (Van Haaren et al., 2010), but, as identified in the previous review report, this does not cover the United States territories. Instead, the population is used as a proxy for the calculation of the nationwide AD, based on the time-series data and the interpolation and extrapolation for filling in the missing data between the years of publication of the survey. Regarding this issue, the ERT also noted that the total waste generated (table A-248 in the NIR) was steadily increasing until 2004 but has decreased since then. Responding to a question raised by the ERT during the review, the United States explained that this issue has been investigated and the United States will be revising the values in its next inventory submission. The ERT reiterates the recommendation from the previous review report that the United States report on the trend of total waste generated and provide explanations, and revise the figures, if necessary. In addition, the ERT reiterates the encouragements in the previous review report for the United States to take into account changes in economic conditions along with the population numbers for interpolation and extrapolation.

104. As identified in the previous review report, the ERT noted that the value of the parameter DOC degraded remains constant across the time series. If a constant value is used, the emission estimation does not capture the changing waste composition over the time series. In response to a question raised by the ERT during the review regarding the constant value for DOC, the United States explained that it is currently conducting a literature review to collect and analyse these data to determine changes to DOC over time and also to investigate regional differences. During the review, the United States was unable to provide the ERT with a revised time series of DOC values for the years 1990–2011. The ERT takes note of the information on the United States' planned improvements related to the use of GHGRP data in future inventories and recommends that the Party revise the estimates of emissions from solid waste disposal on land by incorporating the revised DOC values into the emission estimation in future inventory submissions, in order to increase the accuracy of the inventory. The ERT also reiterates the recommendation in the previous review report that the United States report the composition of waste landfilled, with the amounts/shares and corresponding coefficients (including DOC) in the NIR.

3. Non-key categories

Wastewater handling – CH_4 and N_2O

105. For the emission estimation of CH_4 from industrial wastewater handling the United States used a default tier 1 method with an IPCC default value of 0.25 kg CH_4/kg chemical oxygen demand and country-specific AD reflecting the current wastewater treatment technologies used. This is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. However, the ERT noted that the notation key "NE" was used for CH_4 emissions from sludge under industrial wastewater with the explanation in CRF table 6.B that due to a lack of AD, emissions from this category were not estimated. The ERT

recommends that the United States improve the completeness and transparency of the inventory by including information for this non-estimate in the NIR.

106. For the emission estimation of CH_4 from domestic and commercial wastewater handling, the United States used a country-specific method similar to the IPCC tier 1 method with country-specific EFs and AD reflecting the current wastewater treatment technologies used in the country. This is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. However, the ERT noticed an internal inconsistency in the inventory: in the NIR (p.8-16), the CH_4 emissions from domestic wastewater handling in 2011 were reported as 0.36 Tg CO_2 eq, but the correct value is 7.6 Tg CO_2 eq as reported in CRF table 6.B. Responding to a question raised by the ERT during the review regarding this value, the United States confirmed that the correct value is in the CRF tables. The ERT encourages the United States to revise this value in the NIR of its next inventory submission, consistent with the CRF tables, and recommends that the Party enhance its QC procedures to avoid such inconsistencies.

107. To estimate emissions of N_2O from human sewage, the United States used a method and default EF from the 2006 IPCC Guidelines and country-specific data on annual per capita protein intake for the years 1990–2004 from the USDA Economic Research Service (USDA, 2009). The ERT found that data for the years 2005–2011 were extrapolated based on development indicators for the years 1990–2004. The ERT recommends that the United States make efforts to collect country-specific AD for the years 2005–2012, and revise the emissions for recent years accordingly in its next inventory submission.

Waste incineration – CO_2, CH_4 and N_2O

108. The United States reported all emissions from waste incineration in the energy sector because almost all incineration of waste in the United States occurs within facilities where energy is recovered. However, the reported emission estimates do not include the incineration of non-hazardous industrial waste and medical waste. In response to a question raised by the ERT during the review regarding these waste classes, the United States explained that emissions from the incineration of medical waste were not estimated, but are considered to be very low, especially in comparison with the overall emissions of waste incineration activities that are covered. Additionally, there are limited data sources that provide information on this practice. Nevertheless, the United States mentioned that a potential data source would be to examine data collected under a separate EPA inventory programme for local air quality pollutants. To further improve the completeness of the inventory, the ERT recommends that the United States make efforts to collect the necessary AD for the emission estimation of CH_4 and N_2O from non-hazardous industrial waste and medical waste incineration using, for example, the data collected by EPA, and to include these estimates in future inventory submissions, providing all necessary explanations in the NIR. The ERT also noted that CH_4 emissions from waste incineration (biogenic) were reported as "NE" and encourages the Party to estimate and report emissions for this category.

Other waste (composting of waste) – CH_4 and N_2O

109. For the emission estimation of CH_4 and N_2O from the composting of waste, the United States used a tier 1 method from the 2006 IPCC Guidelines with country-specific AD and an IPCC default EF. The amount of waste composted in the United States has been decreasing since the year 2008 (a decrease of 8.0 per cent). In response to a question raised by the ERT during the review regarding the reasons behind the trend, the United States explained that the number of community composting programmes has been decreasing from 3,227 in 2002 to 3,090 in 2011(a decrease of 4.2 per cent) and that this could explain the downward trend in the amount of waste composted. To further improve the transparency of the inventory, the ERT reiterates the encouragement in the previous review

report for the United States to include this information in the NIR of its next inventory submission.

III. Conclusions and recommendations

A. Conclusions

110. Table 6 summarizes the ERT's conclusions on the 2013 inventory submission of the United States, in accordance with the UNFCCC review guidelines.

Table 6
Expert review team's conclusions on the 2013 inventory submission of the United States of America

		Paragraph cross references
The ERT concludes that the inventory submission of the United States of America is complete (categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2011)		Table 3; paragraph 9
Non-land use, land-use change and forestry[a]	Not complete	Table 3; paragraphs 9, 29, 46, 66 and 101
Land use, land-use change and forestry[a]	Not complete	Table 3; paragraphs 9, 80, 81, 82, 88, 90, 93 and 95
The ERT concludes that the inventory submission of the United States has been prepared and reported in accordance with the UNFCCC reporting guidelines	Yes	Paragraphs 14, 15 and 30
The United States' inventory is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*	Generally, yes	Paragraphs 15, 38, 48, 51, 62, 75 and 92
The institutional arrangements continue to perform their required functions	Yes	Paragraphs 62, 75 and 92

Abbreviations: CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the IPCC *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

111. The ERT identified the issues for improvement listed in table 7 below. All recommendations are for the next inventory submission, unless otherwise specified.

Table 7
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph cross references*
Cross-cutting	Completeness	Improve the completeness of the inventory, in particular for those categories for which there are methodologies in the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF	9, 29, 46, 80
	Recalculations and time-series consistency	Ensure time-series consistency when using GHGRP data directly in the national inventory	11
		Continue to explore legally binding agreements and/or memorandums of understanding with data provider institutions to ensure the timely availability of data, the consistency of the time series, and the full coverage of categories	11
	QA/QC	Report on the results of checks using GHGRP data	13
	Transparency	Use the plant-specific emissions from GHGRP to improve the disaggregation of combustion and industrial process emissions	14
	Transparency and comparability	Follow the UNFCCC reporting guidelines with respect to the use of the 2006 IPCC Guidelines, in particular regarding the reporting of CO_2 emissions from ammonia production (urea). Include justifications for the decision to use default EFs from the 2006 IPCC Guidelines in several sectors	15, 48, 51, 62, 75, 92
Energy	Transparency	Include information on the progress made in using GHGRP data in the inventory and indicate which data have been sourced from GHGRP or from other sources	28
		Report emissions from all categories and for the full time series at the most disaggregated level, in line with the UNFCCC reporting guidelines, in particular for manufacturing industries	30

Sector	*Category*	*Recommendation*	*Paragraph cross references*
		and construction and fugitive emissions	
	Completeness	Collect the necessary AD and EFs to increase the completeness of the inventory. Improve the reporting of emissions from military activities	29
	Reference approach	Provide a more transparent clarification of how the difference in emissions between the reference and the sectoral approaches is determined and which fuels are subtracted as non-energy use and feedstocks	32
	International bunker fuels	Reconcile the data between the reference and the sectoral approach regarding jet kerosene consumption	35
	Feedstocks and non-energy use of fuels	Reallocate the relevant emissions currently reported under the subcategory non-energy use (other) and part of the fuel used under the subcategory United States territories (other)	38
	Stationary combustion: solid, liquid and gaseous fuels – CO_2, N_2O and CH_4	Complete the collection of AD for the consumption of biomass and other fuels for the years 2010 and 2011	39
		Do not deduct the amount of fuel used for the production of intermediate products that are exported from the United States	40
	Civil aviation: liquid fuels – CO_2	Include more complete justifications for the trend of CO_2 emissions in this category	41
	Oil and natural gas – CO_2 and CH_4	Use GHGRP data to improve the resolution and disaggregation of fugitive emissions from flaring and venting	44
Industrial processes and solvent and other product use	Completeness	Improve the completeness of the inventory, in particular for CO_2 emissions from calcium carbide production and CH_4 emissions from styrene	46
	Cement production – CO_2	Include explanations for the use of "advanced" data	49
	Ammonia production – CO_2	Report these emissions in line with the Revised 1996 IPCC Guidelines, ensuring that no underestimations or double counting occur	51
	Iron and steel	Report separately the emissions from	53

Sector	*Category*	*Recommendation*	*Paragraph cross references*
	production – CO_2	metallurgical coke production and iron and steel production	
		Improve the carbon balance for coke plants and, in particular, the use of natural gas in coke production	54
	Aluminium production – PFCs	Provide explanations for the decrease in the PFC IEFs	55
	SF_6 used in aluminium and magnesium foundries – SF_6	Provide information on what has led to the decrease in SF_6 emissions despite the global increase in magnesium demand	56
	Production of HCFC-22 – HFC-23	Ensure that the necessary QA/QC and verification measures are implemented at plant level	57
	Consumption of halocarbons and SF_6 – HFCs and SF_6	Provide further information on the EPA Vintaging model	58
	Lime production – CO_2	Provide explanations for the recalculations of lime production data	60
		Revisit the content of lime in final products	61
	Nitric acid production – N_2O	Provide clear justification for using the 2006 IPCC Guidelines and a clear description of the methodology used, the trend in emissions and changes in the methodologies and parameters used	62
Agriculture	Enteric fermentation – CH_4	Include emissions from calves during the time period when they feed on anything other than milk	69
	Manure management – CH_4 and N_2O	Include explanations for the trends of volatile solids daily excretion and nitrogen excretion rates per animal for dairy cattle	71
		Investigate the reasons for the differences between the trends of volatile solids daily excretion and nitrogen excretion rates per animal that were identified for sheep and swine	72
	Agricultural soils – N_2O	Revise the AD and emissions for cultivation of histosols in agricultural soils and revise the QC process in order to ensure consistency in the inventory	74
		Provide justification for the use of default EFs from the 2006 IPCC Guidelines to estimate N_2O emissions from pasture,	75

Sector	*Category*	*Recommendation*	*Paragraph cross references*
		range and paddock	
		Investigate the reasons for the fluctuation in N_2O emissions for nitrogen leaching and run-off, provide these reasons in the NIR and correct the identified errors and QC procedures	76
		Resolve the inconsistency in the total nitrogen excretion on pasture, range and paddock between CRF tables 4.B(b) and 4.D	77
		Include weighted national averages for the fractions listed in CRF table 4.D and improve the QC procedures	78
LULUCF	Completeness	Increase the completeness of the inventory	80, 81
	Consistency and accuracy	Include all lands in the inventory and improve the consistency of the time series of national areas and report on the achievements made	82
		Ensure land area consistency and accuracy with the use of the land-use change matrices, provide justifications for changes over time and use more recent data on cropland areas	83
	QA/QC	Check the coherence of reported data in the NIR and the CRF tables, applying the appropriate QC checks	84
	Transparency	Provide all estimates of land conversions to forest land, cropland and grassland in a disaggregated manner	85
		Include information on how the different information data sources were harmonized and used to classify the territory in accordance with the IPCC land-use categories in a consistent manner	86
	Forest land remaining forest land – CO_2	Conclude the technical work to implement an integrated approach for tracking land-use change and estimate the forest carbon stock and changes for each subcategory of LULUCF year by year based on the most recent forest inventory data and remotely sensed land-use change information	88
		Calculate the carbon stock values at two consecutive points in time in the same	89

Sector	*Category*	*Recommendation*	*Paragraph cross references*
		area when using the stock change method	
		Report the carbon stock changes in the mineral soils and organic soils pools separately	90
		Implement the integrated approach, based on models and empirical data, to track land-use change and estimate the changes in soil organic carbon for each subcategory of LULUCF year by year	91
	Cropland remaining cropland – CO_2	Reallocate emissions from urea fertilization to the category ammonia production (in the industrial processes sector)	92
		Estimate the carbon stock changes in living biomass in perennial crops	93
	Settlements – CO_2	Eliminate the overlap between the urban forest inventory and the forest inventory	94
		Develop a land-use change data set on land uses that are converted to settlements, and enhance the transparency of the reporting	95
	Other – CO_2	Reflect the intersectoral linkages and document the differences in the decay values for yard trimmings and food scraps	96
	Biomass burning – CH_4 and N_2O	Strengthen the QC procedures to avoid inconsistencies in the reporting between the CRF tables and the NIR	97
		Present more transparent information to justify the use of the extra parameter of 92.8 per cent for estimating non-CO_2 emissions	98
	Wetlands remaining wetlands – CO_2	Improve the consistency between the NIR and the CRF tables and report the areas and the emission estimates in both CRF tables 5.D and 5(II)	99
Waste	Transparency	Provide descriptions of the waste management practices used in the country	102
	Solid waste disposal on land – CH_4	Report on the trend of total waste generated, provide explanations, and revise the data, if necessary	103
		Revise the parameter degradable organic carbon and report the composition of waste landfilled, with the amounts/shares	104

Sector	*Category*	*Recommendation*	*Paragraph cross references*
		and corresponding coefficients	
	Wastewater handling – CH_4 and N_2O	Include information on the non-estimation of CH_4 emissions from sludge under industrial wastewater	105
		Enhance the QC procedures to avoid the inconsistencies detected	106
		Make efforts to collect country-specific data on annual per capita protein intake for the years 2005–2012	107
	Waste incineration – CH_4 and N_2O	Estimate emissions from incineration of non-hazardous industrial waste and medical waste	108

Abbreviations: AD = activity data, CRF = common reporting format, EF = emission factor, EPA = Environmental Protection Agency, ERT = expert review team, GHGRP = Greenhouse Gas Reporting Program, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC good practice guidance for LULUCF = IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, LULUCF = land use, land-use change and forestry, NIR = national inventory report, QA/QC = quality assurance/quality control, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Annex I

Background data on recalculations in the 2013 inventory submission

Table 8
Recalculations in the 2013 inventory submission for the base year and the most recent year

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation ($Gg\ CO_2\ eq$)		*Per cent change*		
1. Energy	**–20 314.00**	**–44 375.87**	**–0.4**	**–0.7**	Improved methodology and AD
A. Fuel combustion (sectoral approach)	7 957.30	27 924.69	0.2	0.5	
1. Energy industries	–8 464.83	–11 588.66	–0.5	–0.5	
2. Manufacturing industries and construction	2 178.69	2 359.43	0.3	0.3	
3. Transport	7 450.31	15 976.59	0.5	0.9	
4. Other sectors	–1.20	–9 305.09	0.0	–1.6	
5. Other	6 794.35	30 482.42	3.5	16.3	
B. Fugitive emissions from fuels	–28 271.30	–72 300.55	–8.0	–20.3	
1. Solid fuels		–220.79		–0.3	
2. Oil and natural gas	–28 271.30	–72 079.76	–10.8	–25.8	
2. Industrial processes	**2 230.22**	**5 423.97**	**1.0**	**3.4**	Improved methodology, EFs and AD
A. Mineral products	–48.60	393.81	–0.1	0.7	
B. Chemical industry	2 090.91	3 834.28	3.5	9.1	
C. Metal production	187.91	1 195.89	0.2	2.0	
D. Other production					
E. Production of halocarbons and SF_6		–1 721.20		–21.3	
F. Consumption of halocarbons and SF_6	2.76	–3 686.50	0.0	–2.8	
G. Other					
3. Solvent and other product use					
4. Agriculture	**26 095.97**	**33 860.64**	**6.7**	**7.9**	Improved methodology, EFs and AD
A. Enteric fermentation	–1 104.78	–2 015.93	–0.8	–1.4	
B. Manure management	–708.26	–809.52	–1.5	–1.2	
C. Rice cultivation					
D. Agricultural soils	27 909.31	36 686.52	14.0	17.7	
E. Prescribed burning of savannas					
F. Field burning of agricultural residues	–0.30	–0.43	–0.1	–0.1	

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
G. Other					
5. Land use, land-use change and forestry	**87 244.93**	**185 993.49**	**–10.1**	**–17.6**	Improved methodology, EFs and AD
A. Forest land	4 469.21	97 721.76	–0.8	–11.5	
B. Cropland	14 190.39	21 480.11	–70.3	–1 346.1	
C. Grassland	59 030.24	30 411.45	–82.0	–95.3	
D. Wetlands		27.06		2.7	
E. Settlements	9 555.09	30 187.12	–17.0	–31.3	
F. Other land					
G. Other		6 165.98		–7.8	
6. Waste	**116.69**	**–1 117.34**	**0.1**	**–0.8**	Improved AD
A. Solid waste disposal on land	116.86	–1 072.55	0.1	–1.0	
B. Wastewater handling	–0.17	37.56	0.0	0.2	
C. Waste incineration					
D. Other		–82.35		–2.5	
7. Other					
Total CO_2 equivalent without LULUCF	**8 128.88**	**–6 208.59**	**0.1**	**–0.1**	
Total CO_2 equivalent with LULUCF	**95 373.81**	**179 784.90**	**1.8**	**3.2**	

Abbreviations: AD = activity data, EF = emission factor, LULUCF = land use, land-use change and forestry.

Annex II

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/ 2006gl /index.html>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/ invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/ gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09. pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/ docs/cop8/08.pdf>.

Status report for the United States of America 2013. Available at <http://unfccc.int/resource/docs/2013/asr/usa.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2013. Available at <http://unfccc.int/resource/webdocs/sai/2013.pdf>.

FCCC/ARR/2012/USA. Report of the individual review of the inventory submission of the United States of America submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/usa.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Leif Hockstad (Environmental Protection Agency), including additional material on the methodologies and assumptions used. The following document[1] was also provided by the United States of America:

Leverenz, H.L, Tchobanoglous, G., Darby J. L.. 2010. *Evaluation of Greenhouse Gas Emissions from Septic Systems*. Water Environment Research Foundation (WERF) and IWA Publishing.

[1] Reproduced as received from the Party.

Annex III

Acronyms and abbreviations

AD	activity data
AWMS	anaerobic animal waste management systems
C_2F_6	perfluoroethane
CF_4	perfluoromethane
CH_4	methaneCO_2 carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degradable organic carbon
DOM	dead organic matter
EF	emission factor
ERT	expert review team
FAO	Food and Agriculture Organization of the United Nations
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HCFC-22	hydrochlorofluorocarbon-22
HFC-23	trifluoromethane
HFCs	hydrofluorocarbons
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
kha	thousands of hectare meters
LUC	land-use change
LULUCF	land use, land-use change and forestry
Mha	millions of hectare meters
N	nitrogen
NA	not applicable
NE	not estimated
Nex	nitrogen excretion rate
N_2O	nitrous oxide
NIR	national inventory report
ODS	ozone-depleting substances
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride
SOC	soil organic carbon
T	tonnes
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10^{12} joule)
VS	volatile solids
Ym	methane conversion rate
UNFCCC	United Nations Framework Convention on Climate Change